SECTION 02501 - STANDARDS OF ROADWAY GEOMETRIC DESIGN

PART 1 – GENERAL

1.1 The Indiana Design Manual (IDM) in conjunction with the AASHTO Green Book for Geometric Design, latest versions, shall govern if their standards are more stringent than what is outlined and specified below.

1.2 Secondary Plats shall conform to the following requirements and standards:

A. Minimum Roadway Cross Section Width

1. Minimum roadway cross section widths, to be installed at the subdivider's expense, shall be as follows:

a. Primary Arterials, Per Westfield Thoroughfare Plan generally described as follows: 150 feet of right of way, four (4) lanes at 12 feet, 16 feet center turn lane and/or divided grass landscaped median, plus two (2) feet curb and 6 inch and gutter and two (2) 8 foot asphalt multi-use trails. Reference the most current Westfield Thoroughfare Plan.

b. Secondary Arterials, Per Westfield Thoroughfare Plan generally described as follows: 120 feet of right of way, four (4) lanes at 12 feet, or two (2) lanes at 12 feet plus 16 feet center turn lane and/or divided grass landscaped median, plus two (2) feet and 6 inch curb and gutter and two (2) 8 foot asphalt multi-use trails. Reference the most current Westfield Thoroughfare Plan.

c. Collector Streets, Per Westfield Thoroughfare Plan generally described as follows: 100 feet of right of way, 36 feet back of curb to back of curb (2 feet and 6 inches curb and gutter) and two (2) 8 foot asphalt multi-use trails. Reference the most current Westfield Thoroughfare Plan.

d. Local Streets: 31 feet back of curb to back of curb (2 feet curb and gutter). See Westfield Standard Drawing (WSD) 02501-001.

e. Subdivision Streets: Per WSD 02501-001 and 002.

f. The pavement of a turning circle at the end of cul-de-sacs shall have a minimum outside diameter of 84 feet for local cul-de-sacs and 100 feet for all others. Cul-de-sacs with an island shall not be permitted.

g. Frontage Roads: Per WSD 02501-003.

h. Alleys: Per WSD 02501-010.

i. In all commercial areas, the minimum pavement width shall be 42 feet back of curb to back of curb or as approved by variance by the WPWD Engineer.

2. All streets shall be designed to the standards herein. Inverted crowns shall not be permitted which includes private streets.

3. In all industrial areas, the minimum pavement width (excluding curb and gutter) shall be 24 feet with 8 feet of shoulder on each side of the pavement with "No Parking" on the shoulders.

4. Street trees shall not be within 4 feet of any curb, sidewalk, or trail. All trees and shrubs shall properly match the most current City of Westfield Parks Department Master Tree and Shrub List.

B. Street Grades, Curves, and Sight Distances

1. The minimum vertical grade for all streets shall be 0.5%.

2. Maximum Vertical Grades

a. The maximum vertical grade for Primary Arterials and Secondary Arterials shall be 5%.

b. The maximum vertical grade for Collectors shall be 8%.

c. The maximum vertical grade for Local Roads or Streets shall be 8%.

d. The first 25 feet of an intersecting roadway, from the outer edge of a through roadway, shall be designed with a two percent (2%) downward grade. With a sag vertical curve situation, the two percent grade shall connect with the remaining street profile grade using a minimum vertical curve length of 50 feet. This sag vertical curve may start at the edge of the through roadway. With a crest vertical curve at the approach to an intersection, the two percent downward grade shall extend 25 feet from the edge of the through roadway and the crest vertical curve can begin at that point. The length of the crest vertical curve shall meet the requirements of the latest AASHTO Standards for crest vertical curves. Variances from this provision shall require a Spot Elevation Detail to be reviewed and approved by the WPWD Engineer. No standing water will be allowable at

intersections. ADA/PROWAG specifications shall be met at all intersections and other pedestrian crossing areas.

3. Vertical curves shall be designed to meet or exceed the latest AASHTO Standards for sag and crest vertical curves, sight distance, vertical clearance, and any other geometric guideline associated with vertical design.

4. Horizontal alignments shall be designed to meet or exceed the latest AASHTO Standards for curve radii, sight distance, superelevation, tangent length between two radii, and any other geometric guideline associated with horizontal design.

5. All AASHTO Standards shall correspond to the following design speeds:

   a. Local Roads or Streets shall have a design speed of 30 mph.

   b. Collectors shall have a minimum design speed of 30 mph. Consult with the WPWD Engineer for further guidance.

   c. Primary Arterials and Secondary Arterials shall have a minimum design speed of 40 mph. Consult with the WPWD Engineer for further guidance.

6. Each cul-de-sac shall have a terminus of circular shape with minimum right-of way diameter of 108 feet for residential use and 120 feet for industrial use (variance alternative is 2 times the radius for the length of the street). Refer to WSD 02501-012 for additional details.

C. Intersections

1. At street and alley intersections, property line corners shall be rounded by an arc, the minimum radius of which shall be 20 and ten (10) feet respectively. A tangential chord may be substituted for such arc.

2. Street curb intersections shall be rounded by radii of at least 25 feet. A radius of 40 feet shall be used at the intersection with a Primary Arterial, Secondary Arterial or Collector street.

3. The above minimum radii shall be increased when the angle of street intersection is less than 90 degrees. AutoTurn exhibits may be required if a special design vehicle needs to be accommodated at the discretion of the WPWD Engineer.

4. Intersections of more than two (2) streets at one point will not be allowed.

5. Street jogs with centerline offsets of less than 125 feet shall not be permitted.

6. All streets shall intersect at 90 degrees whenever possible for a minimum distance of 100 feet; however, in no instance shall they intersect at less than 80 degrees onto Primary Arterials, Secondary Arterials, or Collectors; or at less than 70 degrees onto Local Roads or Streets.

7. The following paragraphs shall be required as provisions of restrictive covenants of all Secondary Plats to which they apply:

   a. No fence, wall, hedge, tree or shrub planting which obstructs sight lines and elevations between three (3) and nine (9) feet above the street shall be placed or permitted to remain on any corner lot within the triangular area formed by the street right-of-way lines and a line connecting points 40 feet from the intersection of said street lines 40 feet for Collectors and Local Roads and Streets; and 75 feet for Primary Arterials and Secondary Arterials, or in the case of a rounded property corner, from the intersection of the street right-of-way lines extended.

   b. The same sight line limitations shall apply to any lot within ten (10) feet of the intersection of a street right-of-way line with the edge of the driveway pavement or alley line. No driveway shall be located within 75 feet of the intersection of two streets, unless otherwise approved in writing by the WPWD Engineer.

8. At the intersection of any proposed Subdivision Road, Local Road, Street or Drive with a Primary Arterial, Secondary Arterial, or Collector, acceleration and deceleration lanes, passing blisters or left turn lanes shall be provided on the Primary Arterial, Secondary Arterial, or Collector. Reference Figure 02501-013.

9. The design of roundabouts shall follow the manual below:

   a. Federal Highway Administration NCHRP Report 672 “Roundabouts: An Information Guide” Second Edition Indiana Design Manual or most current edition.

D. Easements

1. Where alleys are not provided, easements for utilities shall be provided. Such easements shall have minimum widths of 20 feet, and where located along lot lines, one-half the width shall be taken from each lot.

2. Where a subdivision is traversed by a watercourse, drainage ditch, channel, or stream, adequate areas for storm water or drainage easements shall be allocated for the purpose of widening, deepening, sloping, improving or protecting said watercourses in accordance with the requirements of the Hamilton County Drainage Board, WPWD, and other governing bodies that have jurisdiction over these water courses.

3. The Subdivider shall be encouraged to design for the placement of utility lines underground, following the required standards and specifications established by each utility company. The location of each underground utility system shall be shown by appropriate easement lines on the proposed plat.

E. Obstruction Free Zones

The obstruction free zone is defined as the roadside area next to the travel way which shall be free from hazards and obstructions. Obstacles within the obstruction free zone limits shall be removed, made breakaway, or shielded with guardrail. The obstruction free zone values given below are minimums and shall be extended where accident experience indicates a wider zone would further enhance safety. The following obstruction free zones apply to roadway projects:

1. Rural and Urban Arterials with Shoulders. Where the design speed is 50 mph or greater and the design ADT is over 1500, the minimum obstruction free zone is 20 ft from the edge of the through traffic lanes or to the right-of-way line, whichever is less. For roadways where the design speed is less than 50 mph, and the design ADT is less than 1500, the minimum obstruction free zone from the edge of through traffic lanes is 10 ft plus the usable shoulder width provided, or to the right-of-way line, whichever is less.

2. Rural and Urban Collectors with Shoulders. Where the design speed is 50 mph or greater and the design ADT is over 1500, the minimum obstruction free zone from the edge of the through traffic lanes is 10 ft plus the usable shoulder width provided, or to the right-of-way line, whichever is less. For Roadways where the design speed is less than 50 mph and design ADT is less than 1500, the minimum obstruction free zone from the edge of through traffic lanes is 6.5 ft, plus the

usable shoulder width provided, or to the right-of-way line, whichever is less.

3. Rural and Urban Local Roads and Streets with Shoulders. The minimum obstruction free zone from the edge of the through traffic lane is 6.5 ft plus the usable shoulder width provided, or to the right-of-way line, whichever is less.

4. Curbed Roadways. Where curbs are 6 in. or higher and the posted speed limit is less than 50 mph, the minimum obstruction free zone from the face of the curb shall be 1.6 ft. However, for traffic signal supports the minimum obstruction free zone shall be 2.6 ft. Where the curbs are less than 6 in. in height or the posted speed limit is 50 mph or greater regardless of curb height, the minimum obstruction free zone will be the same as defined in Items A, B, or C above.

5. Appurtenance-Free Area. Roadways for all functional classifications shall have a 1.6 ft appurtenance-free area from the face of curb or from the edge of the travel lane if there is no curb. For traffic signal supports, a 2.6 ft clearance shall be provided. The appurtenance free area is defined as a space in which nothing, including breakaway safety appurtenances, shall protrude above the paved or earth surface. The objective is to provide a clear area adjacent to the roadway in which nothing will interfere with extended side-mirrors on trucks, with the opening of vehicular doors, etc.

6. On-Street Parking. The following obstruction-free zone requirements will apply to facilities with on-street parking.

    a. Continuous 24-Hour Parking. No obstruction-free zone is required on facilities where there is continuous 24-hour parking, except that the appurtenance-free area as shown in Figure 55-5A shall be provided from the face of the curb or edge of the parking lane if there is no curb.

    b. Parking Lane Used as a Travel Lane. The obstruction-free zone shall be determined assuming the edge of the parking lane as the right edge of the farthest right travel lane.

7. The designer shall eliminate or modify the following hazards, according to the above treatments, if they are within the obstruction free zone:

a. Tree Removal. Trees that will mature to a diameter of 4 in. or more shall be removed from the obstruction free zone, unless shielded by a protective device required for other purposes. Trees on back slopes may generally remain if they are unlikely to be impacted by errant vehicles.

b. Obstructions. Obstructions within the obstruction free zone, such as rough rock cuts, boulders, headwalls, foundations, etc., with projections that extend more than 4 in. above the ground line shall be removed, relocated, made breakaway or shielded with guardrail as appropriate. A rough rock cut is one that presents a potential vehicular snagging problem.

c. Sign and Light Supports. Sign posts and light poles to remain within the obstruction free zone will be made breakaway. In urban areas where pedestrian traffic is prevalent, breakaway light supports shall not be used. However, these supports should, as a minimum, be offset beyond the obstruction free zone value as presented in Section 02501 – 1.1 – E or desirably behind the sidewalk. In other areas where pedestrian traffic is prevalent, the use of breakaway supports will be considered on a case-by-case basis by the field review team.

d. Traffic Signals. Traffic signal supports shall be placed to provide the obstruction-free zone through the area where the traffic signal supports are located. However, the following exceptions will apply:

    i. Channelized Islands. Installation of signal supports in channelizing islands shall be avoided, if practical, however, if a signal support must be located in a channelizing island, a minimum clearance of 30 ft shall be provided from all travel lanes (including turn lanes) in rural areas and in urban areas where the posted speed is greater than 45 mph. In urban areas where the island is bordered by a barrier curb and the posted speed is 45 mph or less, a minimum clearance of 10 ft shall be provided from all travel lanes (including turn lanes).

    ii. Non-Curbed Facilities (Posted Speeds $\geq$ 50 mph and ADT > 1500). Where conflicts exist such that the placement of the signal supports outside

of the obstruction-free zone is impractical (e.g., conflicts with buried or utility cables), the signal supports shall be located at least 10 ft beyond the outside edge of the shoulder.

iii. Non-Curbed Facilities (Posted Speeds < 50 mph or ADT ≤ 1500). Where conflicts exist such that the placement of the signal supports outside of the obstruction-free zone is impractical (e.g., conflicts with buried or utility cables), the signal supports shall be located at least 6.5 ft beyond the outside edge of the shoulder.

e. Culverts. Culvert ends are considered to be within the obstruction free zone if the point at which the top of the culvert protrudes from the slope is within the obstruction free zone. Transverse Slopes on Side Roads and Private Drives. Steep transverse slopes on side roads and private entrances shall be considered for flattening, if practical. Desirably these slopes shall be 6:1 or flatter, but in no case shall they be steeper than 4:1. Transverse slopes on median crossovers will be 10:1 or flatter.

f. Curbs. Curbs shall generally be removed on rural highways where posted speeds are greater than 45 mph. The proper placement of traffic control devices must be considered in reviewing the removal of corner island curbs where such devices are located. This item is not intended to cover divisional (channelizing) islands separating two-way traffic or curbs at the edge of shoulder for drainage. In the latter two cases, sloping curbs shall be used on highways with posted speeds greater than 45 mph. Curbs higher than 4 in. shall not be used in conjunction with guardrail. The face of curbs, used in conjunction with guardrail, shall desirably be behind the face of the rail. If this cannot be achieved, the face of the curb may be located flush with the face of the rail.

g. Utility Poles. Utility poles within the obstruction free zone which are not owned by the City of Westfield or INDOT often constitute a significant hazard and shall be removed or relocated outside of the proposed right of way as to not interfere with any proposed or existing sidewalk or trail. Additional easements for utility poles outside of the right of way may be required by the utility company. Utility companies shall be requested to

relocate utility poles that are located in high vulnerability areas such as channelizing islands, or where the accident history indicates there has been a utility pole accident problem. The WPWD, based on their judgment, will determine where such work is warranted.

h. Utility Pedestals. Existing utility pedestals shall be removed or relocated outside of the proposed right of way as to not interfere with any other utilities. New utility pedestals shall be placed outside of the proposed right of way and shall be installed as to not interfere with any other utilities.

i. Non-Traversable Hazards. Fill slopes steeper than 1:1 with a height greater than 2 ft within the obstruction-free zone shall be flattened to the extent practical. If any part of a drainage ditch appears within the obstruction-free zone, it shall be relocated.

F. Bridges

1. The design of vehicular bridges shall follow the manual below:

a. AASHTO LRFD Bridge Design Specifications 6th Edition with 2013 Interim Revisions or most current edition.

2. The design of pedestrian bridges shall follow the manuals below:

a. AASHTO LRFD Guide Specification for the Design of Pedestrian Bridges 2nd Edition or most current edition.

b. AASHTO Guide for the Development of Bicycle Facilities Fourth Edition or most current edition.

PART 2 - PRODUCTS

Not Applicable

PART 3 - EXECUTION

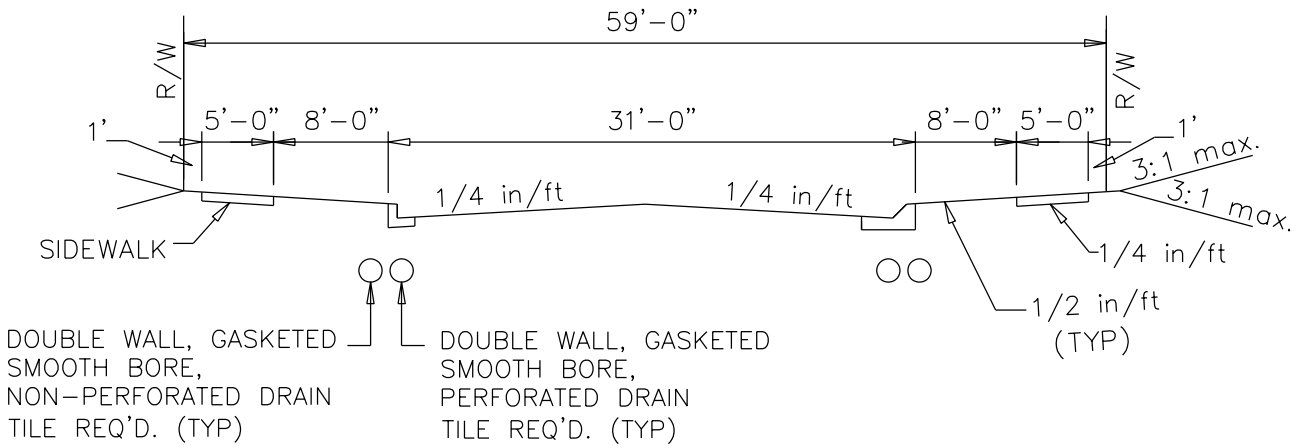
Not Applicable

PART 4 – FIGURES

4.1 STANDARD GENERAL DETAILS

FIGURE	DESCRIPTION
02501-001	Typical Cross Section – Local Street
02501-003	Typical Cross Section – Frontage Road
02501-010	Typical Cross Section – Local Alley
02501-013	Minimum Subdivision and Commercial Entrance
02501-015	Residential Driveway
02501-016	Sight Triangle Details

END OF SECTION 02501



TYPICAL SECTION – LOCAL STREET

NOTES:

1. The curb & gutter shall be Type I or Type II as shown on the Curb & Gutter standard sheets. Type II curb & gutter shall be used adjacent to, and in, non-residential or multi-family residential areas and on entrances of residential development along thoroughfares.
2. For curb and gutter detail, see Figure 2500-008
3. 8'-0" tree buffers are required for all local streets. Refer to the City of Westfield street tree planting specifications for additional details. For approved species, see Master Tree List.

TYPICAL CROSS SECTION: LOCAL STREET

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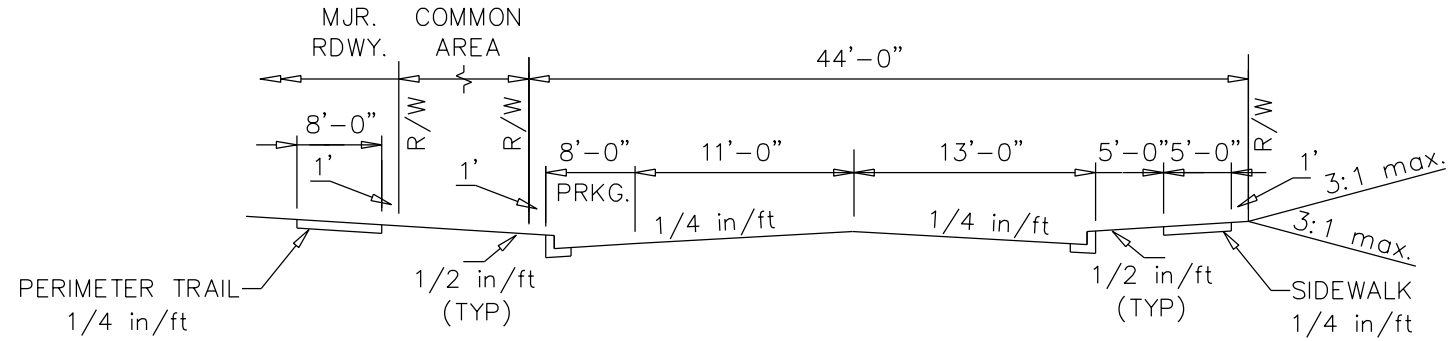
FIGURE 2501-001



TYPICAL SECTION – RESIDENTIAL FRONTAGE ROAD
Scale: NTS

NOTES:

1. The curb & gutter shall be Type I or Type II as shown on the Curb & Gutter standard sheets. Type II curb & gutter shall be used adjacent to, and in, non-residential or multi-family residential areas and on entrances of residential development along thoroughfares.
2. For curb and gutter detail, see Figure 2500-008. For perimeter trail detail, see Figure 2505-001
3. Refer to the current Westfield Thoroughfare Plan Section 5.1 for the typical cross sections for Collector, Secondary Arterial, and Primary Arterial.
4. For residential applications, see Figure 2500-001 for pavement section details. For mixed-use or commerical applications, see Figure 2500-002 for pavement section details.
5. For street tree applications, buffers should be widened to 10'-0". Add'l R/W Req'd. For two-sided on-street parking applications, back-of-curb to back-of-curb width shall be widened to 38'-0". Add'l R/W Req'd.
6. Common Area width varies depending on landscaping plan, utilities, and other incidentals. 10' min.

TYPICAL CROSS SECTION: RESIDENTIAL FRONTAGE ROAD

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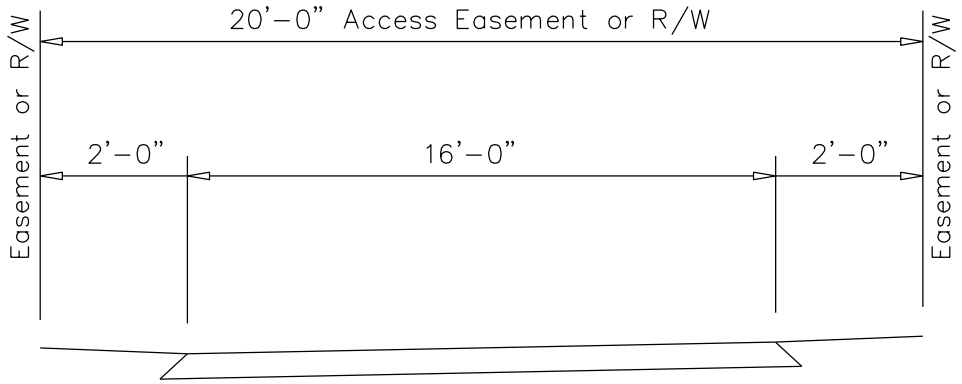
FIGURE 2501-003



TYPICAL SECTION – LOCAL ALLEY
Scale: NTS

NOTES:
1. If hydrants located in alley, pavement section shall be widened to 20'–0". Add'l R/W Req'd.
2. For residential applications, see Figure 2500–001 for pavement section details. For mixed–use or commerical applications, see Figure 2500–002 for pavement section details.
3. Pavement may be crowned or sloped to one side, no inverted crowns. Designer to handle drainage accordingly.
4. If two–way traffic is allowable, pavement shall be widened to 20'–0". Add'l R/W Req'd.
5. If utility, drainage or any other easements required, min. 10'–0" easements shall be added outside of the access easement/right–of–way.

TYPICAL CROSS SECTION: LOCAL ALLEY

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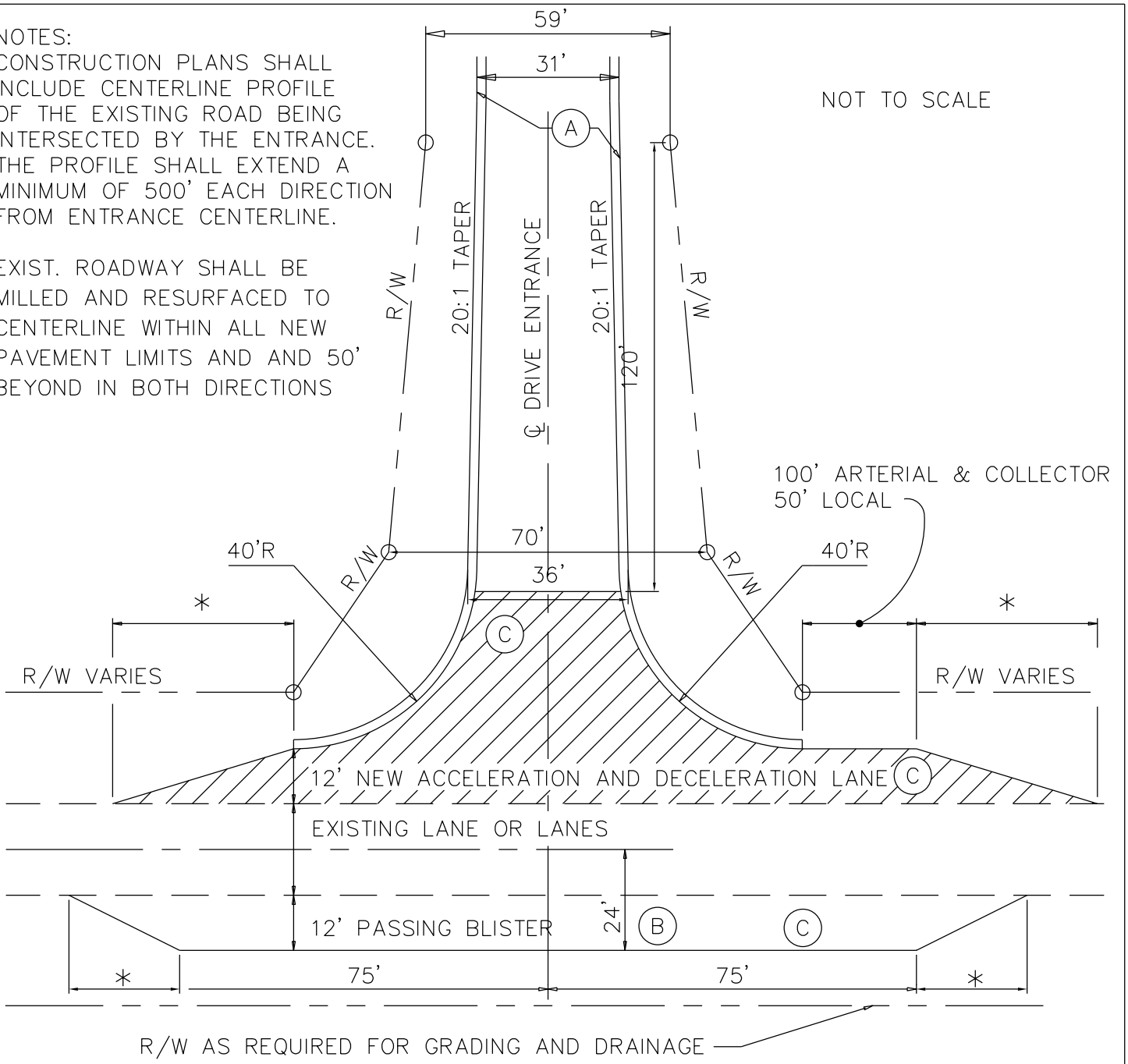
FIGURE 2501–010

NOTES:
CONSTRUCTION PLANS SHALL INCLUDE CENTERLINE PROFILE OF THE EXISTING ROAD BEING INTERSECTED BY THE ENTRANCE. THE PROFILE SHALL EXTEND A MINIMUM OF 500' EACH DIRECTION FROM ENTRANCE CENTERLINE.

EXIST. ROADWAY SHALL BE MILLED AND RESURFACED TO CENTERLINE WITHIN ALL NEW PAVEMENT LIMITS AND AND 50' BEYOND IN BOTH DIRECTIONS

NOT TO SCALE



(A) 2' CURB & GUTTER

(B) PASSING BLISTER WHEN REQUIRED

(C) LANE WIDENING SHALL MATCH EXIST. PAVEMENT SURFACE TYPE

* 150' ARTERIAL
100' COLLECTOR
75' LOCAL

MIN. SUBDIVISION AND COMMERCIAL ENTRANCE

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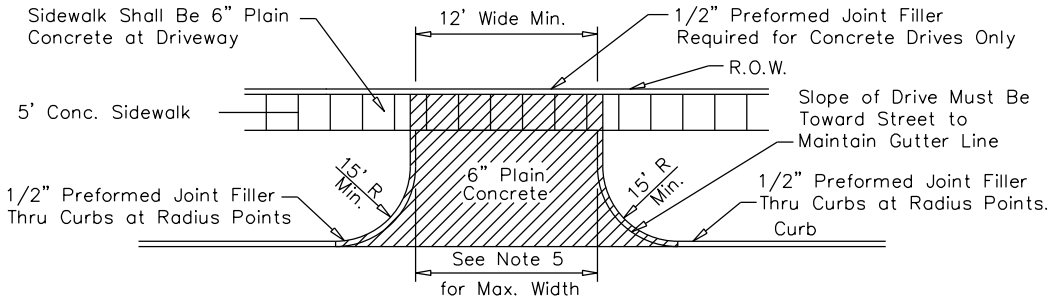
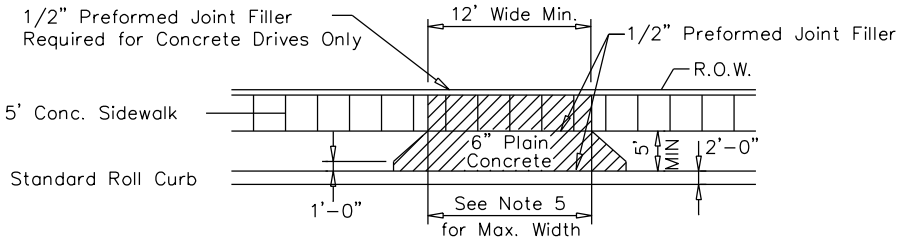
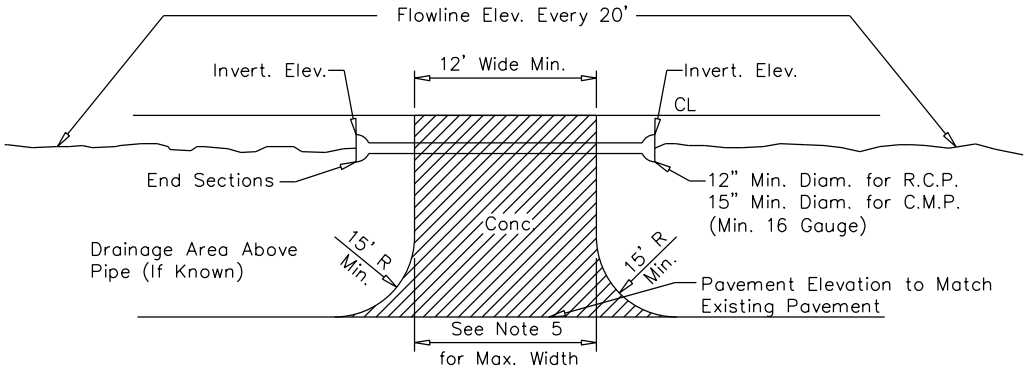
FIGURE 2501-013



PRIVATE DRIVE WITH CURB AND SIDEWALK



PRIVATE DRIVE WITH ROLLED CURB AND GUTTER WITH SIDEWALK



PRIVATE DRIVE WITH OPEN DITCHES

GENERAL NOTES

1. Cross-hatched areas shall be 6" PCCP, Class A.
2. Metal or Concrete end section shall be constructed on all pipes.
3. Subgrade under all curbs, sidewalks and drives shall be compacted in accordance with INDOTSS.
4. Sidewalks shall be constructed in accordance with the appropriate standard and shall be continuous across the driveway.
5. 20' Wide Max. for Zoning Class SF5
   20' Wide Max. for Zoning Class SF4
   26' Wide Max. for Zoning Class SF3
   30' Wide Max. for Zoning Class SF2
   30' Wide Max. for Zoning Class AG-SF-1
6. No handicap ramps permitted to fall in any portion of driveway.

RESIDENTIAL DRIVEWAYS

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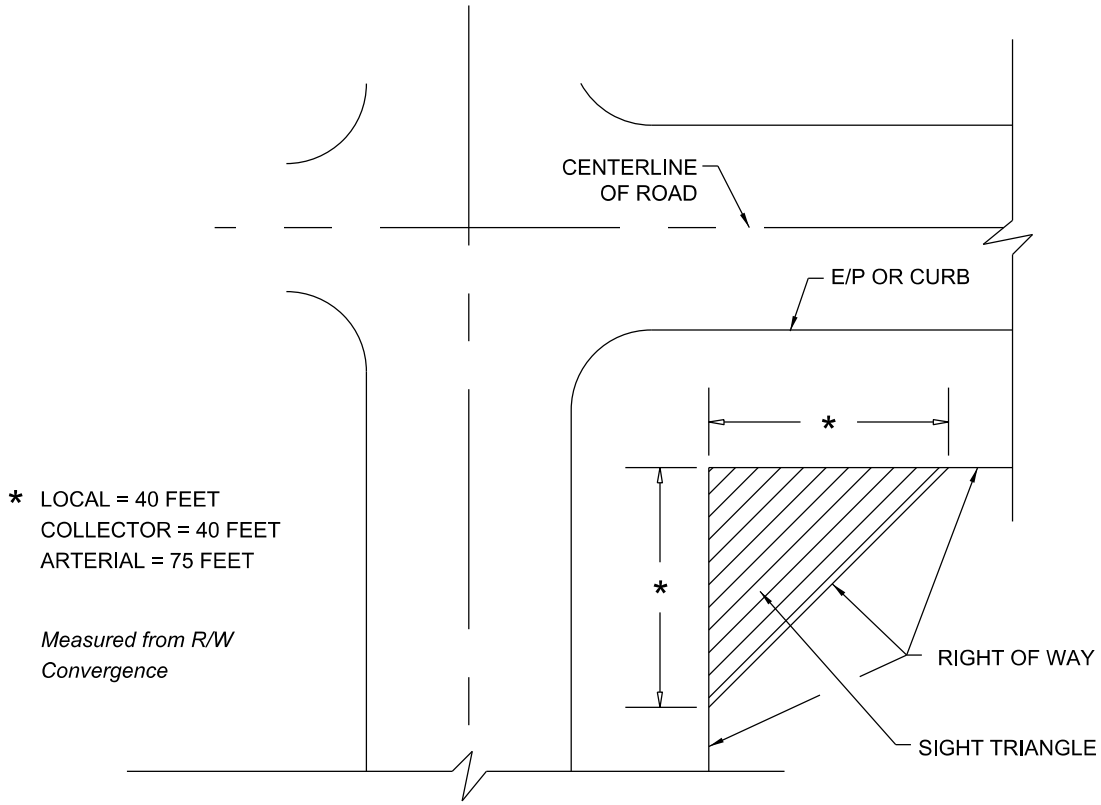
FIGURE 2501-015



SIGHT TRIANGLE FOR LOCAL, COLLECTOR, AND ARTERIAL ROADWAYS

NOTES:

1. NO FENCE, WALL, HEDGE, TREE OR SHRUB PLANTING WHICH OBSTRUCTS SIGHT LINES AND ELEVATIONS BETWEEN THREE (3) AND NINE (9) FEET ABOVE THE STREET SHALL BE PLACED OR PERMITTED TO REMAIN ON ANY CORNER LOT WITHIN THE TRIANGULAR AREA FORMED BY THE STREET RIGHT-OF-WAY LINES AND A LINE CONNECTING POINTS 40 FEET FROM THE INTERSECTION OF SAID STREET LINES. 40 FEET FOR COLLECTORS AND LOCAL ROADS AND STREETS; AND 75 FEET FOR PRIMARY AND SECONDARY ARTERIALS, OR IN CASE OF A ROUNDED PROPERTY CORNER, FROM THE INTERSECTION OF THE STREET RIGHT-OF-WAY LINES EXTENDED.
2. FOR PRIVATE STREETS USE 25 FEET FROM EDGE OF PAVEMENT ALONG PRIVATE STREET AND 40 FEET FROM EDGE OF PAVEMENT ALONG PUBLIC STREET.
3. FOR ANY VARIANCE FROM THIS STANDARD DRAWING, EXHIBITS IN ACCORDANCE WITH THE INDIANA DESIGN MANUAL CHAPTER 46-10.0 SHALL BE SUBMITTED TO THE WESTFIELD ENGINEER FOR REVIEW AND APPROVAL.

INTERSECTION SIGHT DISTANCE

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FIGURE 2501–016